WHAT WE CLAIM IS:

1. A high-frequency module comprising:

a multi-layer substrate of a plurality of laminated dielectric layers;

an antenna terminal;

a diplexer connected to the antenna terminal for branching a plurality of transmission/reception systems different in pass band from one another;

switch circuits connected to the diplexer for switching the transmission/reception systems to transmission systems and reception systems;

power amplifiers connected to the switch circuits for amplifying transmission signals in the pass bands of the transmission systems; and

matching circuits for matching the impedances of the power amplifiers to one another,

the power amplifiers and the switch circuits respectively being formed by high-frequency semiconductor integrated circuit elements, and

these high-frequency semiconductor integrated circuit elements being mounted on the surface of the multi-layer substrate.

2. A high-frequency module according to Claim 1, wherein directional couplers for taking out monitor signals from transmission signals of the transmission systems, are

disposed between the switch circuits and the power amplifiers.

3. A high-frequency module according to Claim 2, further comprising an automatic power control circuit connected to the directional couplers for supplying, to the power amplifiers, control signals corresponding to the monitor signals taken out from the directional couplers.

4. A high-frequency module according to Claim 3, wherein the automatic power control circuit is formed by a high-frequency semiconductor integrated circuit element, and this high-frequency semiconductor integrated circuit element is mounted on the surface of the multi-layer substrate.

5. A high-frequency module according to Claim 1, further comprising a current detecting circuit for detecting the amounts of electric currents in the power amplifiers, and an automatic power control circuit for controlling the powers of the power amplifiers based on the current amounts detected by the current detecting circuit.

6. A high-frequency module according to Claim 5, wherein the automatic power control circuit is formed by a high-frequency semiconductor integrated circuit element, and this high-frequency semiconductor integrated circuit element is mounted on the surface of the multi-layer substrate

7. A high-frequency module according to Claim 1,

wherein a low-pass filter for attenuating a harmonic component of a transmission signal, is disposed at at least one position in the signal passages from the antenna terminal to the power amplifiers.

8. A high-frequency module according to Claim 7, wherein at least one low-pass filter is disposed in the signal passages from the antenna terminal to the switch circuits.

9. A high-frequency module according to Claim 1, wherein a high-pass filter or a band-pass filter for attenuating a transient high-voltage surge which entered the antenna terminal, is disposed in the passages from the antenna terminal to the switch circuits.

10. A high-frequency module according to Claim 9, wherein the high-pass filter or the band-pass filter is disposed only in the passage of the transmission/reception system in the lowest frequency band.

11. A high-frequency module according to Claim 1, wherein

a die pad is formed on the surface of the multi-layer substrate,

the high-frequency semiconductor integrated circuit elements forming the power amplifiers are mounted on the surface of the multi-layer substrate through the die pad, and

the die pad is connected, through heat radiating

via-hole conductors formed as passing through the multi-layer substrate, to a ground terminal pattern formed on the underside of the multi-layer substrate.

12. A high-frequency module according to Claim 11, wherein

a die pad is formed on the surface of the multi-layer substrate,

the high-frequency semiconductor integrated circuit elements forming the switch circuits, are mounted on the surface of the multi-layer substrate through the die pad, and

the die pad for the high-frequency semiconductor integrated circuit elements forming the power amplifiers, is not connected to the die pad for the high-frequency semiconductor integrated circuit elements forming the switch circuits by a conductor pattern formed on the surface or inside of the multi-layer substrate.

13. A high-frequency module according to Claim 1, wherein distributed constant lines forming the matching circuits are formed between the portions where the directional couplers, the switch circuits or the diplexer are mounted, and the portions where the high-frequency semiconductor integrated circuit elements for the power amplifiers are mounted.

14. A high-frequency module according to Claim 1,

wherein an interference preventing pattern formed by a conductor layer is formed on the surface or inside of the multi-layer substrate, and the interference-preventing pattern is connected to the ground terminal pattern on the underside of the multi-layer substrate.

15. A high-frequency module according to Claim 14, wherein the interference preventing pattern is disposed between the power amplifiers and any one of the directional couplers, the switch circuits, and the diplexer.

16. A high-frequency module according to Claim 1, wherein the relative dielectric constant of the dielectric layers forming the multi-layer substrate, is not less than 4.

17. A high-frequency module according to Claim 1, wherein the semiconductor integrated circuit elements for the switch circuits are made as a circuit pattern on a substrate of which chief ingredient is GaAs (gallium arsenide) compound.

18 A high-frequency module according to Claim 1, wherein each of conductor layers formed on the dielectric layers forming the multi-layer substrate, is a conductor of which chief ingredient is selected from the group consisting of Ag (silver), Cu (copper), and Au (gold).

19. A high-frequency module according to Claim 1, wherein

the multi-layer substrate incorporates (i) a plurality of voltage supply bias lines for supplying voltages to a plurality of high-frequency amplifying elements, and (ii) an interference preventing ground pattern,

the voltage supply bias lines are so disposed as not to overlap one another in plan elevation, and

slits are formed in the interference preventing ground pattern for separating the same into at least two regions in each of which a voltage supply bias line is being formed.

20. A high-frequency module according to Claim 1, wherein

the multi-layer substrate incorporates (i) a plurality of voltage supply bias lines for supplying voltages to a plurality of high-frequency amplifying elements, and (ii) an interference preventing ground pattern,

the voltage supply bias lines are so disposed as not to overlap one another in plan elevation, and

division grooves are formed in the interference preventing ground pattern for separating the same into at least two regions in each of which a voltage supply bias line is being formed.

21. A high-frequency module according to Claim 1, wherein

the multi-layer substrate is provided on the underside thereof with a ground terminal pattern, a bias terminal

patterns, and signal terminal patterns for connecting the high-frequency module to an external circuit, and

the ground terminal pattern is disposed at the center of the underside of the multi-layer substrate.

22. A high-frequency module according to Claim 21, wherein a plurality of terminal patterns for signal terminal patterns, bias supply terminal patterns and/or ground terminal patterns, are disposed, in a plurality of peripheral rows, around the ground terminal pattern disposed at the center of the underside of the multi-layer substrate.

23. A high-frequency module according to Claim 22, wherein, out of the terminal patterns around the ground terminal pattern disposed at the center of the underside of the multi-layer substrate, the terminal patterns at the outermost peripheral row are allocated to ground terminal patterns.

24. A high-frequency module according to Claim 21, wherein at least one of the signal terminal patterns and/or bias supply terminal patterns is formed inside of the ground terminal pattern disposed at the center of the underside of the multi-layer substrate.

25. A high-frequency module according to Claim 21, wherein all or some of the signal terminal patterns, the ground terminal pattern or the bias terminal patterns on the underside of the multi-layer substrate is partly or wholly

exposed, and the region which is not exposed is coated with an overcoat glass.

26. A high-frequency module according to Claim 1, wherein

voltage supply bias lines are connected to the high-frequency amplifying elements forming the power amplifiers, and

capacitors are connected to the voltage supply bias lines, and inductors are connected between the capacitors and the grounds.

27. A high-frequency module according to Claim 26, wherein the inductors connected to the capacitors are connected to ground conductors through via-hole conductors formed in the dielectric layers.

28. A high-frequency module according to Claim 26, wherein the inductors connected to the capacitors are connected to ground conductors through via-hole conductors formed in the dielectric layers and conductor patterns formed in the dielectric layers.

29. A high-frequency module according to Claim 26, wherein at least a portion of the voltage supply bias lines is formed on the surface of the dielectric multi-layer substrate, and capacitors connected to the voltage supply bias lines are mounted on the surface of the dielectric multi-layer substrate.

30. A high-frequency module according to Claim 26, wherein the capacitors are formed by a pair of electrodes which sandwich dielectric layers of the multi-layer substrate therebetween.

31. A high-frequency module according to Claim 1, wherein

voltage supply bias lines are connected to the high-frequency amplifying elements forming the power amplifiers, and

low-capacity capacitors are connected to the voltage supply bias lines.

32. A high-frequency module according to Claim 31, wherein the capacitors have a capacity of not greater than 100 pF.

33. A high-frequency module according to Claim 31, wherein at least a portion of the voltage supply bias lines is formed on the surface of the dielectric multi-layer substrate, and capacitors connected to the voltage supply bias lines are mounted on the surface of the dielectric multi-layer substrate.

34. A high-frequency module according to Claim 31, wherein the capacitors are formed by a pair of electrodes which sandwich dielectric layers of the multi-layer substrate therebetween.

35. A radio communication apparatus on which the

high-frequency module according to Claim 1 is mounted.